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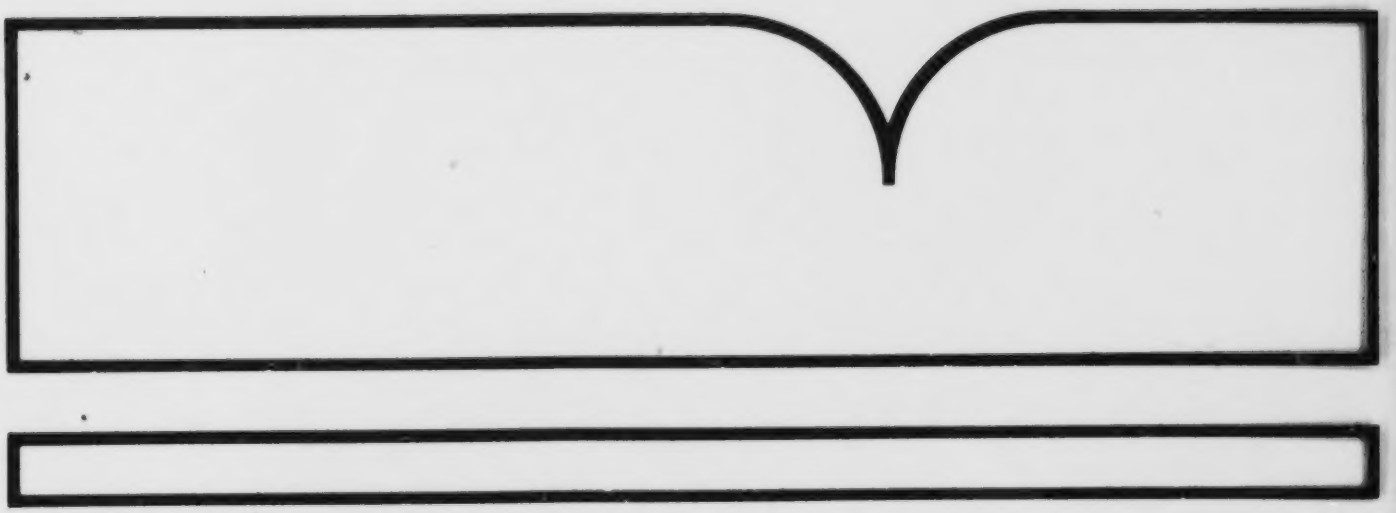
Residential Wood Combustion Study. Task 2B. Household Information Survey

Green (Del) Associates, Inc., Woodburn, OR

Prepared for

Environmental Protection Agency, Seattle, WA

Jun 82



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Surveys on residential wood combustion practices were conducted in the metropolitan areas of Portland, Oregon, and Seattle & Spokane, Washington, in the spring of 1981. These surveys were part of the Residential Wood Combustion study investigating various aspects of the air pollution impact associated with increasing residential wood burning in the Pacific Northwest. The two major goals were to gather specific data on woodburning activities during February 1981, as well as to gather general data on woodburning practices. The interest in woodburning activity during February was because temporary air monitoring stations were operated in the survey areas during that period. Each survey area was selected to include a one-mile square area around the air monitoring stations, so that the survey information could be correlated to the ambient data. The results of this ambient monitoring study are reported under Task 1 of this project (EPA 910/8-82-089a).

The survey results are summarized in this report, with the data presented in chart form. The survey methodology, the statistical analyses performed, and the problems encountered are discussed.

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Task 2B
Household Information Survey

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RESIDENTIAL WOOD COMBUSTION STUDY

TASK 2B

HOUSEHOLD INFORMATION SURVEY

RESIDENTIAL WOOD COMBUSTION STUDY

TASK 2B

HOUSEHOLD INFORMATION SURVEY

FINAL REPORT

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June, 1982

THIS REPORT CONSISTS OF SEVERAL DIFFERENT PARTS.

THEY ARE LISTED BELOW FOR YOUR CONVENIENCE.

EPA 910/9-82-089a	Residential Wood Combustion Study Task 1 - Ambient Air Quality Impact Analysis
EPA 910/9-82-089b	Task 1 - Appendices
EPA 910/9-82-089c	Task 2A - Current & Projected Air Quality Impacts
EPA 910/9-82-089d	Task 2B - Household Information Survey
EPA 910/9-82-089e	Task 3 - Wood Fuel Use Projection
EPA 910/9-82-089f	Task 4 - Technical Analysis of Wood Stoves
EPA 910/9-82-089g	Task 5 - Emissions Testing of Wood Stoves Volumes 1 & 2
EPA 910/9-82-089h	Task 5 - Emissions Testing of Wood Stoves Volumes 3 & 4 (Appendices)
EPA 910/9-82-089i	Task 6 - Control Strategy Analysis
EPA 910/9-82-089j	Task 7 - Indoor Air Quality

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I. INTRODUCTION

Surveys on residential wood combustion practices were conducted in the metropolitan areas of Portland, Oregon, and Seattle & Spokane, Washington in the Spring of 1981. These surveys were part of a larger project investigating various aspects of the air pollution impact associated with increasing residential wood burning in the Pacific Northwest. The two major goals were to gather specific data on woodburning activities during February 1981, as well as to gather general data on woodburning practices. The interest in woodburning activity during February was because temporary air monitoring stations were operated in the survey areas during that period. Each survey area was selected to include a one-mile square area around the air monitoring stations, so that the survey information could be correlated to the ambient data. The results of this ambient monitoring study is reported under Task 1 of this project. The general background information gathered from this survey will be used as supporting information for predicting wood use trends and for developing possible control strategies to reduce air pollutants from the use of woodburning devices (Task 2A and 6 of the project). Basic demographic information, such as household income and house size, also was gathered to determine if there is any significant correlation between these parameters and woodburning practices. Based on this information and the 1980 census data, the survey results for these small geographic areas then might be used to help predict city-wide residential woodburning activities.

The survey results are summarized in this report, with the data presented in chart form. The survey methodology, the statistical

analyses performed, and the problems encountered will be discussed.

II. SURVEY METHODOLOGY

The survey was designed and administered by two sponsoring agencies, the Wood Energy Association (a Portland trade association), and the Washington Energy Extension (University of Washington). Both groups are interested in wood use practices in their areas and agreed to participate in this survey. The sponsoring agencies mailed the surveys in May, 1981 and a week after the mailing, a reminder postcard was sent to all households that had received the survey. After the complete surveys had been received by the sponsoring agencies, they were sent to Del Green Associates, Inc. for processing and analysis.

The questionnaire was pretested to ensure that there were no significant problems with it. Fifteen questionnaires were hand distributed in an area near the Spokane survey area in April, 1981. No major misunderstandings or other problems with the questionnaire were uncovered.

Sample Selection

Reverse telephone directories for Portland, Seattle, and Spokane were used to obtain lists of households within the study area. The target area for the surveys was a one-mile square area surrounding the monitoring stations. Maps of the cities were used to determine which streets and address ranges fell within a one-mile square area. Only residences were included in the lists; all business addresses were excluded. A few residences located in apartment complexes or

trailer parks also were eliminated when a preliminary inspection of the study area showed no evidence of chimneys.

After the final lists had been prepared, a random selection of 800 households was obtained for each of the three cities; the surveys were mailed to these households.

Response to Survey

The proportion of the sample returning surveys varied for the three cities. The rate was highest in Spokane where 58 pecent of the sample responded to the survey. The lowest response rate was obtained for Portland at 36 percent, while in Seattle, 48 percent returned the surveys.

Among the individuals who failed to respond to the survey, were some who sent back blank surveys, some who wrote reasons for refusal to answer the survey, and some who were no longer at the address. Blank surveys were received from three percent of the Portland sample, four percent of the Seattle sample, and one percent of Spokane. Surveys returned with the notation that the addressee had moved ranged from one percent to three percent. Outright refusals were received from nine individuals in Portland, one in Seattle, and four in Spokane. Among the reasons for refusal that were given were "none of your business", "against use of wood", "don't use wood", and "not applicable". None of these surveys were considered respondents.

Quality Assurance

Prior to coding, each questionnaire was edited for consistency and obvious errors or misunderstandings by the respondents. Errors were

corrected where possible. In those cases where there was an obvious discrepancy but the correct answer could not be determined, the data was left as received from the respondents. Some minor additional editing occurred when the data was recorded for various statistical analyses.

In processing the surveys, codes were assigned to all responses to the questions; the codes were then recorded on specially prepared computer coding forms, one coding form for each survey. The accuracy of the coding then was checked by coders who had not participated in the original coding. Every tenth survey was re-coded to verify the accuracy of coding and transcription.

The number of surveys checked in this manner was 126 (out of a total of 1111 surveys), and these surveys had a total of 11,340 responses (90 responses on each survey). The total number of errors found was 19 or .2 percent. The 95 percent confidence interval for number of errors in another 126 surveys has a lower limit of 10.4 errors and an upper limit of 27.5 (The confidence interval was obtained from tables for the Poisson distribution). This means that if another 126 surveys were randomly chosen, there is a 95% chance that there will be between 10 and 28 errors on the 11,340 responses (90 responses/ survey).

The next step in processing the data was keypunching onto computer cards. This process was done two times, each time by a different keypuncher, in order to eliminate any errors. The two cards were compared, and any differences (indicating a keypunch error) were investigated and corrected.

A final quality assurance check was made on the data by a run on a computer using the Statistical Package for the Social Sciences (SPSS). Inspection of these statistics provided another check on the data by insuring that all responses fell into the proper response range and categories. One error was discovered during this process. This error, and all others that had been found, were corrected.

Statistical Analysis

All computer computations were done with the SPSS. Some data modifications were performed on the data before summary statistics were obtained. The data modifications included re-coding of data and construction of new variables used to obtain totals from variables taken directly from the survey.

Before statistics were computed for number of cords burned in February, some modifications were made in the data. A number of respondents seemed to have misread the questions concerning wood use in February. Instead of giving the percentage burned in February of the annual amount of wood burned (i.e., of all the wood burned in a year in stove #1, 23% was burned in February), some respondents gave percent of wood burned in each stove (i.e., of all the wood burned in February, 50% was burned in stove #1). Thus, frequently the sum of percentages for the three stoves (or three fireplaces) added to 100 percent, implying wood was only used in February. To correct for this in the data, responses were treated as missing whenever the percentages for multiple stoves added to 100 percent.

Summary statistics for the responses to the survey were obtained separately for each of the three survey areas. Some statistics were

obtained for the total samples in each survey area, while some were performed on subgroups -- subgroups used included woodburning households and users of fireplaces, wood stoves, and furnaces. For all questions requiring quantitative responses, means, standard deviations, and standard errors were obtained. For items with qualitative responses, frequencies and proportions of responses were calculated. A copy of the questionnaire is included in Appendix A.

III. SURVEY RESULTS

These charts and figures present data for the entire group surveyed in each area and for certain sub-groups, such as those households using wood burning stoves within the previous 12 months. Because of the many different potential uses for these data, some parameters (e.g., average annual wood use per household) are presented for several different groups (all households, households using any woodburning device within the last 12 months, households using wood stoves in February, etc.). Care should be taken by the reader that the correct group or sub-group is assigned to each data point.

It also should be noted that many of the questions were to be answered only by some of the people questioned, and that in other cases not everyone answered questions that they were supposed to answer. This resulted in many different numbers of respondents ("N" values) being used to calculate average values. Percentages in the tables are based on calculations which excluded respondents who omitted questions they should have answered. For example, in Area A, 86 respondents indicated they had a wood stove, 185 indicated they had no wood stove, and 17 did not answer the question. Table 1, therefore, records that 31.7% have wood stoves, which is calculated by excluding the 17 non-answers as follows: $\frac{86}{185+86} \times 100\% = \frac{86}{271} \times 100\% = 31.7\%$.

The attached charts give the numerator (86 in the example), so that the adjusted total number of respondents (the denominator or "N" value) can be calculated, if desired.

Some statistical data for the more important parameters are included in Table 15. An approximate 95% confidence interval for the mean can be obtained by multiplying the standard error by 2 and adding and subtracting this value from the mean* (e.g., for cords of wood burned in Area A, the first line in the table, a confidence interval, 1.0 ± 0.2 would be obtained). These confidence intervals can be applied only to the population in the small areas sampled and not to the total populations in the cities. For the other data, some very rough estimates of the reliance to be placed on the data can be inferred from the number of respondents in the sample. (For example, 50% value is more impressive if it reflects 150 of 300 responses than if it reflects 1 or 2 responses.)

Finally, in interpreting these results it should be remembered that the survey areas were only one square mile each within much larger urban areas. The results cannot readily be assumed to be representative of the entire city-wide area.

Summary of Survey Areas

All three survey areas were chosen to surround the three temporary ambient monitoring sites, which in turn were chosen because they were in residential areas with evidence of substantial woodburning activities. Other considerations for the monitoring sites were

---

* The factor 2 was obtained by rounding the 1.96 value found in the table for this level of significance. A more accurate estimate of the confidence interval could be obtained by multiplying the standard error by a finite population correlation factor, approximately .9 for Area A and Area B and .7 for Area C. Since results are only approximate due to deviations from normality, and can be applied only to small portions of the city, application of the correction factor to make small reductions in the length of the confidence interval is not warranted.

security, available power supply, and meeting EPA criteria for siting of monitors. The monitoring sites are discussed in more detail in Appendix 1 of Task 1 - Ambient Air Quality Impact Analysis.

Area A - Portland Metropolitan Area - The Portland survey area is located in Multnomah County, immediately adjacent to Southeast Portland but outside the city limits. Figure 1 shows two maps giving the location of the survey area.

The neighborhood surveyed is a working class area, with an average annual household income of $18,400 and the predominant occupation of the head of the household being production. The homes are relatively old (average age of 36 years) and small (1400 square feet), with single family residences prevailing. Fireplaces were the most common type of woodburning devices (36.9% of homes), closely followed by wood stoves at 31.7%. More than half the wood burned was in wood stoves, however.

Area B - Seattle Metropolitan Area - This survey area is located in Bellevue, a community four miles due east of Seattle across Lake Washington. Two maps of the survey area are given in Figure 2.

The average annual household income of those surveyed was $35,000, indicating an upper middle class neighborhood. The residences were predominately newer (1962) large (2300 square feet) single family residences owned by the occupants. Fireplaces were present in 97.1% of the homes, with wood stoves present in only 13.5%.

Area C - Spokane Metropolitan Area - The Spokane survey area is located just north and outside the City limits. This community is characterized by newer (1961), medium sized (1700 square feet) single family homes. The average annual family income was $27,700, representing

FIGURE 1

Area A Map

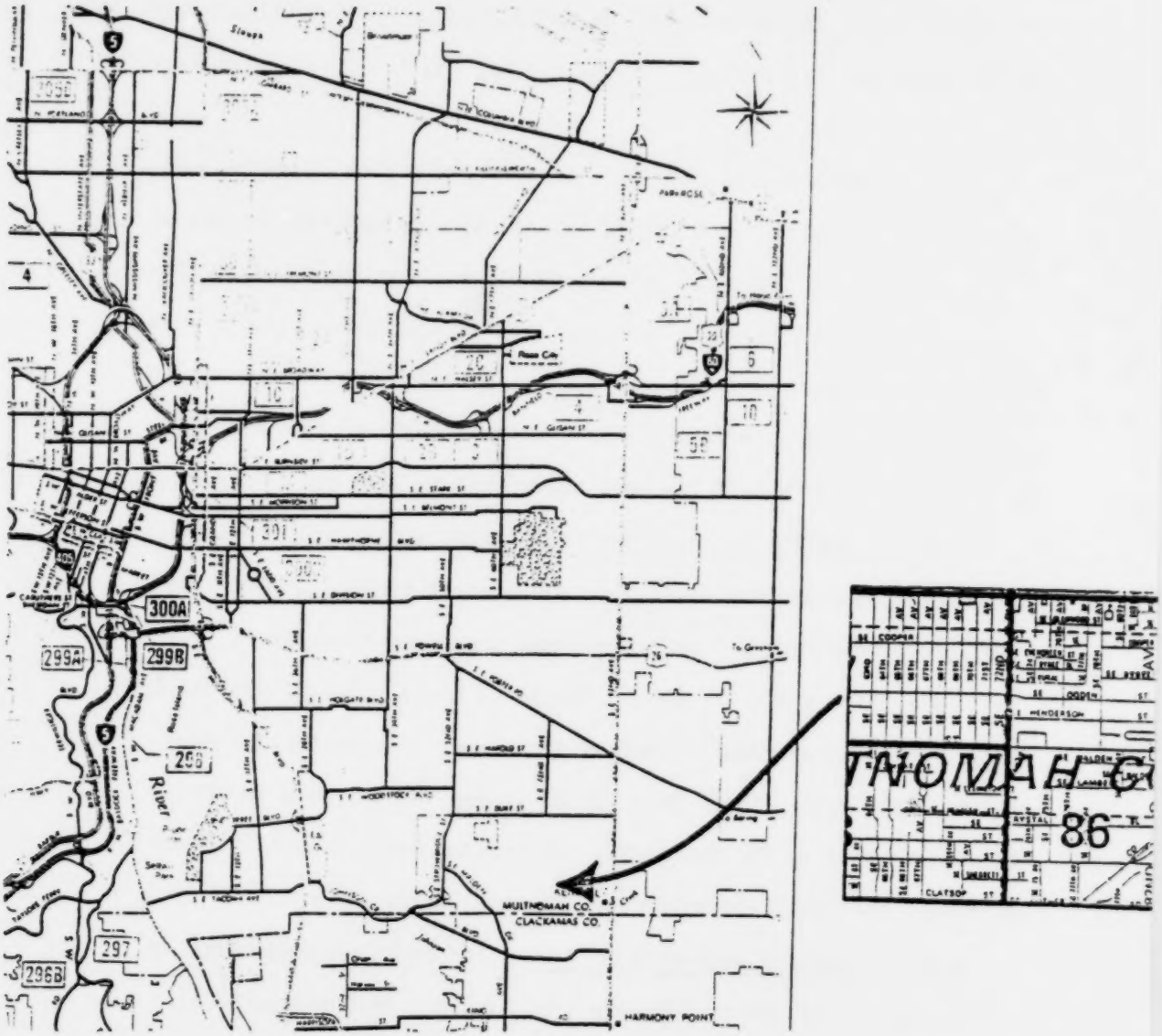
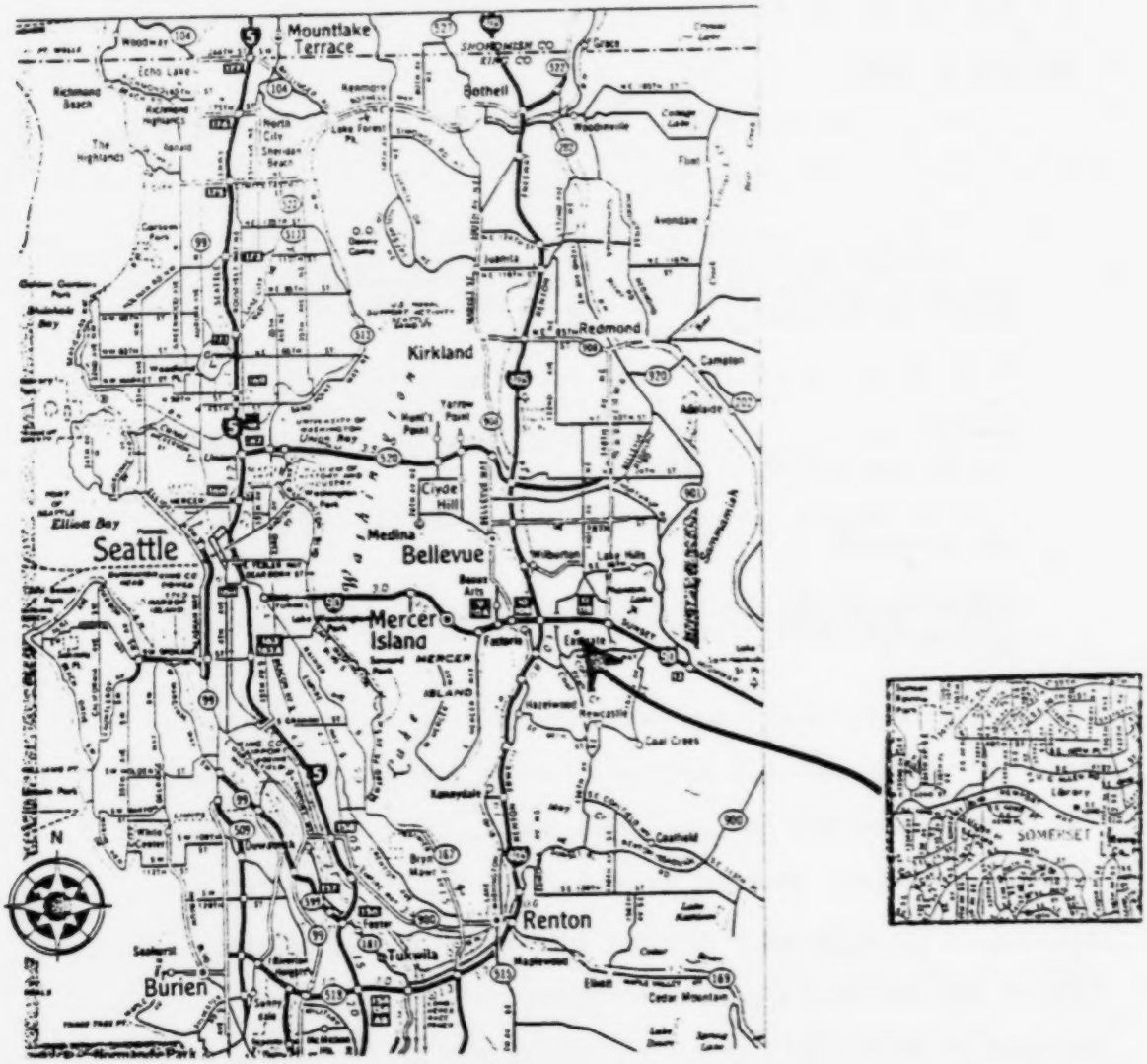


FIGURE 2

Area B Map



a middle to upper middle class neighborhood. Figure 3 includes two maps showing the survey area.

Fireplaces are by far the predominant woodburning device, with 97% of the households surveyed having one or more. Only 11.7% of the homes had wood stoves, but 22.8% of the wood used was by wood stoves.

Analysis of Data

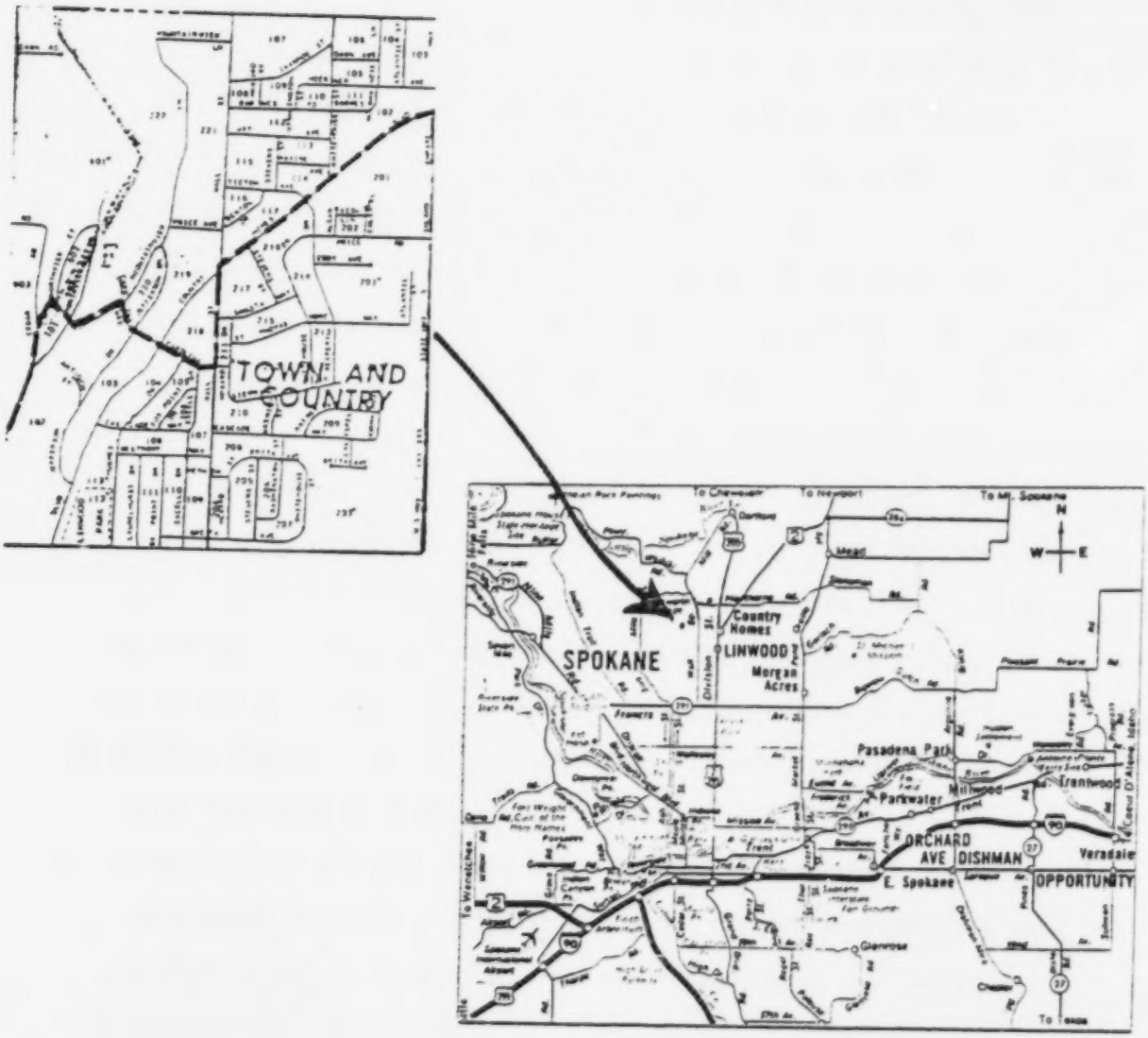
Without going into detail, several general statements on wood use in these three survey areas can be made.

- Relatively few households use wood as their primary heat source (5-14%), but most households now use wood at least as a secondary source of heat and burn substantial quantities of wood (1.0 to 1.6 cords/year/household).
- Based on the respondents' anticipated wood use in the 1981-82 heating season and plans to purchase new woodburning units, it appears that wood use will continue to increase substantially, at least in the short-term.
- Fifty to seventy percent of the wood burned was chopped by the homeowner.
- A majority of the wood was aged over one-year (about 65%) and stored under cover (about 75%) prior to burning.

As previously explained, the survey areas were very small (one square mile each) and were chosen to furnish data to correlate with the short-term ambient monitoring program, rather than to be representative of each city. However, an attempt was made to determine from this survey if there was a relation between certain demographic data and some of the important wood use parameters surveyed. If wood use could be shown to be dependent on the age of the head of the household, for example, then a case could be made for extrapolating these survey results

FIGURE 3

Area C Map



to the total populations of each city based on 1980 census data for a given age group.

Wood consumption was broken down by various demographic and wood usage variables. Summaries of the results are presented in Table 13 for variables for which a significance level of .05 or less was reached in an analysis of variance test. The only result that was obtained for all three cities was that those who cut their own firewood burn significantly more wood than those who purchase their firewood.

Cross-tabulations were obtained between the demographic variables and some variables related to wood usage. Table 14 gives these cross-tabulations for which a significant chi-square level was reached (.05 or less) in a test for independence of the variables in the tables. This test shows whether or not two variables are related (i.e., does wood usage depend on the age of the head of the household). No significant associations between variables were found to hold in all three cities. Past levels of wood consumption and wood storage location were unrelated to demographic variables. Expected levels of wood consumption 1981-82 were associated with one demographic variable, age, in Area A and Area B with the youngest people (under 35 years old) expecting to increase consumption. Plans to buy stoves, fireplaces, or inserts were associated with demographic variables in Area C, butnot in Area B. (Statistics for Area A were excluded here because too few respondents planned any purchases).

The lack of consistent correlations between cities would indicate that extreme caution should be used in extrapolating these survey results to each city or to the Pacific Northwest as a whole. It should be noted

that the areas surveyed were very small and that the statistically significant correlations found might only apply to the small sections of each city that was studied in the survey.

IV. COMPARISON WITH OTHER RECENT SURVEYS

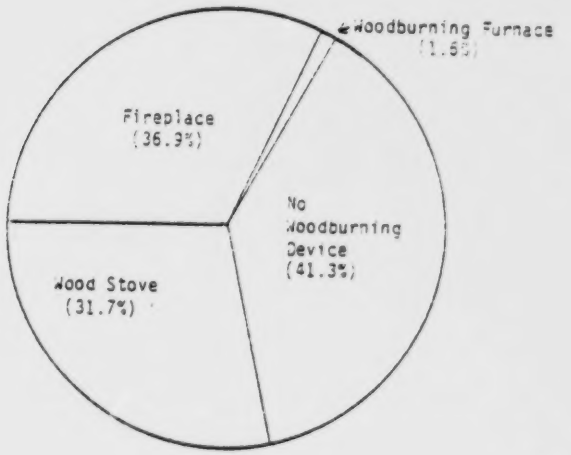
Three other recent surveys on wood burning practices are compared with the results from this survey in several of the attached tables. These surveys were the Talbott Wong and Associates survey for Portland (1979), the Bonneville Power Administration survey for the Pacific Northwest (1980), and the Puget Sound Power and Light Company survey for their service area in northwest Washington (1980). The results of these survyes are used and discussed in another task of this project dealing with wood use trends.

Comparing and drawing conclusions from these surveys are difficult for several reasons. The areas surveyed varied considerably; this survey covered only one square mile in the three urban areas and respondents were generally pre-selected for occupants of single family dwellings; the other surveys covered much larger areas and generally included rural as well as urban areas, and apartments as well as single family dwellings. A second difficulty encountered was that relatively few questions could be specifically compared, either because the same question was not asked in each survey or they were asked of different groups (i.e., type of wood used was asked of all respondents in one study, of those who used devices in February, 1981 in this study). The time lapse between the surveys also could be significant, as several of the surveys indicated rapid and large changes in patterns of wood use occurring in the late 70's and early 80's.

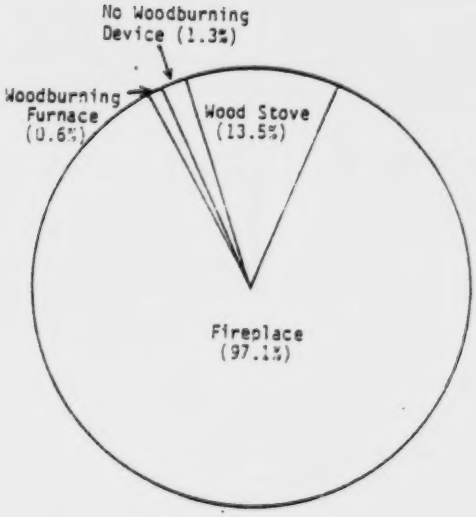
FIGURE 4**

Woodburning Device Usage For All Households Surveyed*

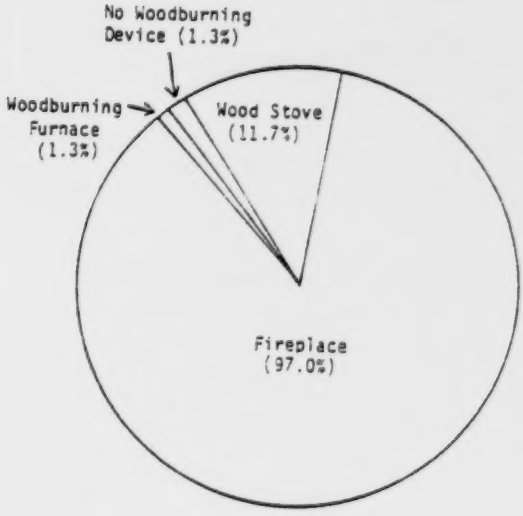
Area A



Area B



Area C



* Percentages do not add up to 100% since some households have more than one type of woodburning device.

** See page 8 for description of areas.

FIGURE 5

Wood Burned by Type of Woodburning Device

Area A

Area B

Area C

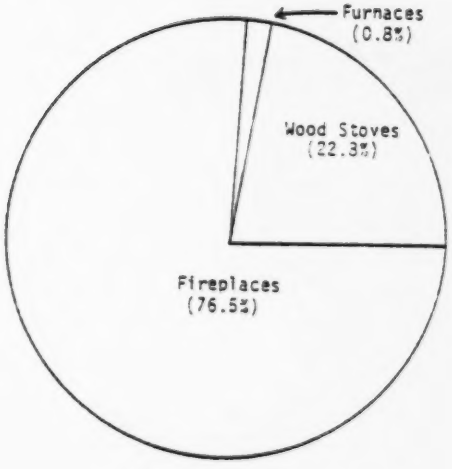


FIGURE 6

Main Source of Home Heating

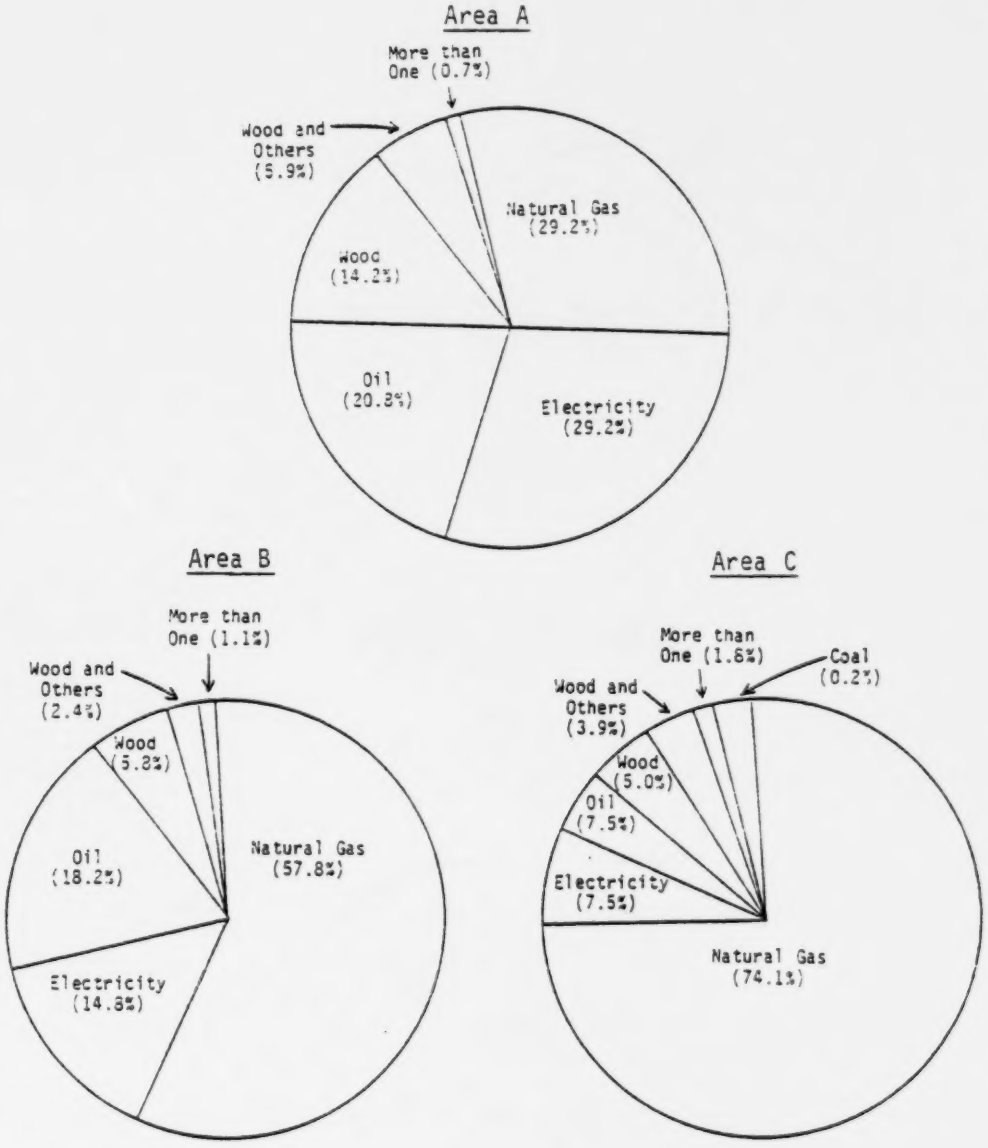
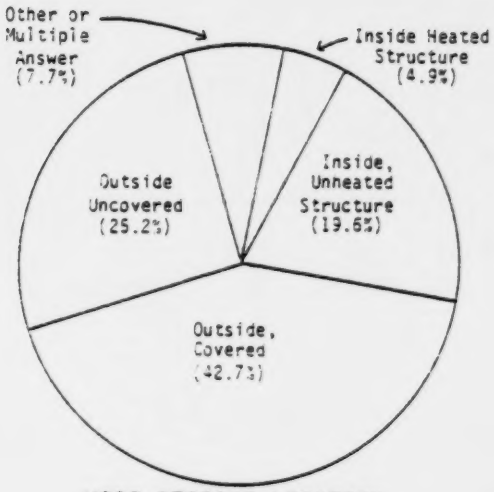
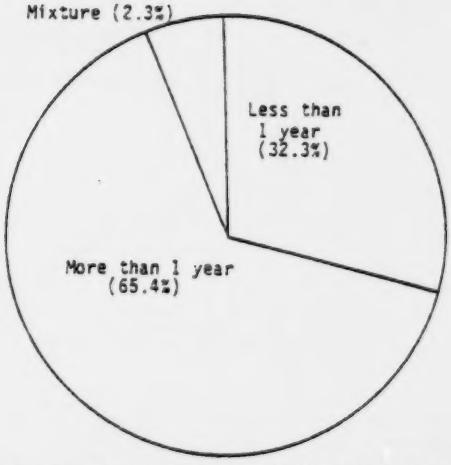


FIGURE 7

Wood Storage Practices
Area A



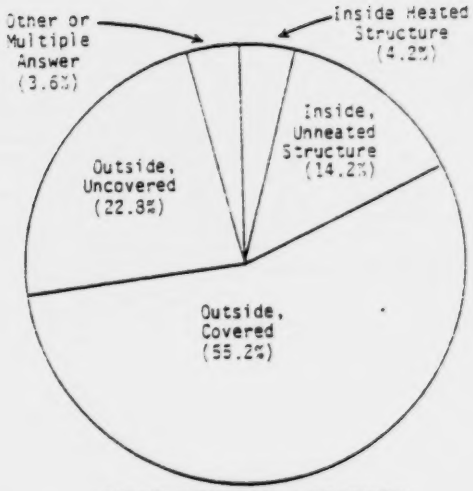
WOOD STORAGE LOCATION



TIME BETWEEN CUTTING AND BURNING

FIGURE 8

Wood Storage Practices
Area B

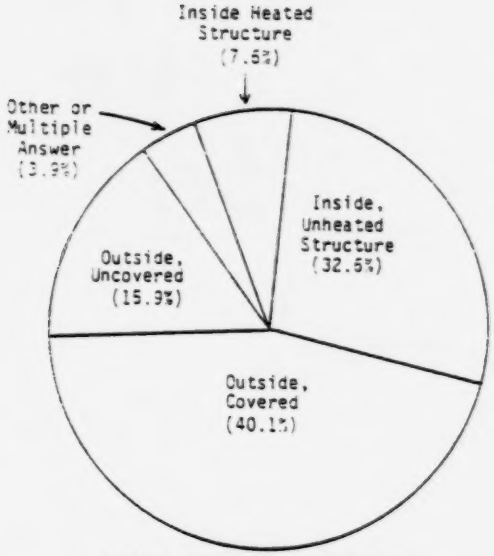


WOOD STORAGE LOCATION

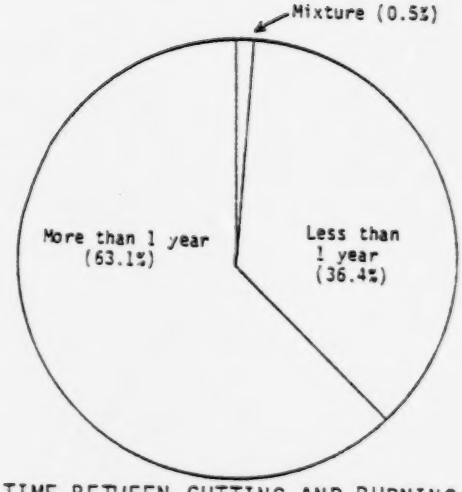
TIME BETWEEN CUTTING AND BURNING

FIGURE 9

Wood Storage Practices
Area C



WOOD STORAGE LOCATION



TIME BETWEEN CUTTING AND BURNING

TABLE 1 *

Summary of Survey Results

Parameter	Area A	Area B	Area C
Number of households returning questionnaire	288	380	443
Number of questionnaires sent out	800	800	800
Total number of households in survey area (excluding apartments without chimneys, and trailer parks) - based on homes with listed or unlisted phones	2082	1429	930
Households using a wood burning unit within last 12 months	49.7%	84.5%	79.7%
Households using wood as a primary source of heat	14.2%	5.8%	5.0%
Households having:			
Wood stove	31.7%	13.5%	11.7%
Fireplaces	36.9%	97.1%	97.0%
Woodburning furnace	1.6%	0.6%	1.3%
Any woodburning device	58.7%	98.7%	96.6%
No woodburning device	41.3%	1.3%	3.4%
Estimated total number of cords of wood burned in last 12 months (all households in survey area)**	2070 cords/yr	1450 cords/yr	1470 cords/yr

* See page 8 for description of areas.

** This value was calculated assuming the survey respondents were representative of the entire survey areas.

TABLE 1 (Cont.)

Parameter	Area A	Area B	Area C
% of wood burned in each type of device			
Woodstove	56.5%	25.3%	22.8%
Fireplace	39.3%	74.6%	76.5%
Woodburning furnace	4.2%	<<0.1%	0.8%
Average wood use per household (all surveyed)[1]	1.0 cords/yr	1.0 cords/yr	1.6 cords/yr
Average wood use per woodburning household	2.0 cords/yr	1.2 cords/yr	1.9 cords/yr
Households planning to buy woodburning unit	16.5%	23.9%	20.4%
Plans for 1981-82 wood burning compared to 1980-81 (all households)			
More	31.9%	27.8%	27.7%
Same	59.0%	60.7%	62.9%
Less	9.0%	11.5%	9.3%

[1] "Average" refers in this and all tables to be the arithmetic mean.

TABLE 2

Survey Results
Section 1*: Woodburning Stoves

Parameter	Average Values/Percentages (Number of Respondents)		
	Area A	Area B	Area C
Homes having one or more wood burning stoves	31.7% (86)	13.5% (49)	11.7% (48)
For households having woodstove(s):			
Number of wood stoves			
1	94.2% (81)	95.7% (45)	93.6% (44)
2	4.7% (4)	4.3% (2)	6.4% (3)
3	1.2% (1)	0%	0%
Were any wood stoves used in the last 12 months:			
Yes	90.7% (78)	93.8% (45)	97.9% (46)
No	9.3% (8)	6.2% (3)	2.1% (1)
For households using wood stoves in the last 12 months:			
Wood burned in the last 12 months:	2.11 cords (76)	2.15 cords (45)	3.36 cords (45)
For households using wood stoves in February, 1981:			
Days in February wood stove was used	22.6 days (71)	20.0 days (41)	23.3 days (38)
On days in February wood stove used, hours per day wood was burned	10.0 hours (71)	10.6 hours (41)	14.0 hours (38)

* Section number refers to section of survey

TABLE 2 (Cont.)

Parameter	Average Values/Percentages (Number of Respondents)		
	Area A	Area B	Area C
For households using wood stoves in February 1981:			
Kind of wood burned most often in each stove?			
#1 Stove			
Softwood	61.1% (44)	34.1% (15)	88.6% (39)
Hardwood	25.0% (18)	61.4% (27)	2.3% (1)
Prepared wood (Prestolog)	4.2% (3)	--	2.3% (1)
Mixed	9.7% (7)	4.5% (2)	6.8% (3)
#2 Stove			
Softwood	50.0% (2)	--	50.0% (1)
Hardwood	25.0% (1)	100.0% (1)	--
Prepared wood (Prestolog)	25.0% (1)	--	--
Mixed	--	--	50.0% (1)
#3 Stove			
Softwood	100.0% (1)	--	--
Hardwood	--	--	--
Prepared wood (Prestolog)	--	--	--
Mixed	--	--	--
Wood burned in past 12 months	2.39 cords (71)	2.33 cords (41)	3.97 cords (38)
What percentage of the wood burned in the past 12 months was burned in February (Stove #1)?	24.2% (52)	22.6% (34)	24.9% (33)

TABLE 3

Survey Results
Woodstoves by Brand

Brand/Model	Area A		Area B		Area C	
	Number	%*	Number	%*	Number	%*
Acme	5	6.2	-	-	-	-
Airtight	-	-	-	-	1	2.2
All Nighter/Little Moe	1	1.2	-	-	-	-
Arc/Medium	1	1.2	1	2.2	-	-
Arrow/1800	-	-	1	2.2	-	-
Artic	1	1.2	-	-	-	-
Blaze	-	-	2	4.3	-	-
Blazeking	4	5.0	-	-	-	-
Boxwood	-	-	-	-	1	2.2
Buck	-	-	-	-	2	4.3
Carrousel	-	-	-	-	2	4.3
Cast Iron/Pot Belly	-	-	-	-	1	2.2
Centennial	2	2.5	1	2.2	-	-
Circulator Heater (Sears)	-	-	-	-	1	2.2
Cone/36"	1	1.2	-	-	-	-
Country Air	-	-	1	2.2	1	2.2
Country Stove	-	-	1	2.2	-	-
Dee Dai Co., Ltd/6118	-	-	1	2.2	-	-
Efel	1	1.2	-	-	3	6.5
Earth Stove	2	2.5	2	4.3	1	2.2
Elizabethan Parlour	-	-	1	2.2	-	-
Firedrum	-	-	1	2.2	-	-

* Percent of all wood stoves named in survey.

TABLE 3 (Cont.)

Brand/Model	Area A		Area B		Area C	
	Number	% *	Number	% *	Number	%*
Fireside/1000	-	-	1	2.2	-	-
Fireview Wood Heater/180	1	1.2	-	-	1	2.2
Fisher	7	8.8	1	2.2	4	8.7
Forester	1	1.2	-	-	-	-
Franklin	10	12.5	2	4.3	1	2.2
Frontier/Box/1876	1	1.2	1	2.2	-	-
Garrison/#2	1	1.2	-	-	-	-
Glo-Fire/301	1	1.2	-	-	1	2.2
Homemade	2	2.5	-	-	3	6.5
Howard	-	-	-	-	1	2.2
Hurricane/300	1	1.2	-	-	-	-
Insert	-	-	-	-	1	2.2
Jotul	1	1.2	1	2.2	-	-
KMF-69-7310-R	1	1.2	-	-	-	-
Kanyon	-	-	-	-	1	2.2
King	1	1.2	-	-	-	-
Kodiak	1	1.2	-	-	1	2.2
Kresno/PFS-73	-	-	1	2.2	-	-
Little Oregon Stove	1	1.2	-	-	-	-
Lopi	-	-	1	2.2	1	2.2
Majestic/Manchester Pierce	-	-	2	4.3	-	-
Meyers	-	-	1	2.2	-	-

* Percent of all wood stoves named in survey.

TABLE 3 (Cont.)

Brand/Model	Area A		Area B		Area C	
	Number	% *	Number	%*	Number	%*
Monarch Comb.	2	2.5	-	-	-	-
Montag	2	2.5	-	-	-	-
Montgomery Wards	5	6.2	-	-	-	-
Moreland/Space Heater	1	1.2	-	-	-	-
Mountain Aire	-	-	-	-	1	2.2
Norweigian/1977	1	1.2	-	-	-	-
Oak	1	1.2	-	-	-	-
Olympic	1	1.2	-	-	1	2.2
Parlor Stove	-	-	1	2.2	-	-
Pay&Pak/Centennial	-	-	-	-	1	2.2
Pay&Save/Franklin	-	-	1	2.2	-	-
Petit Godin/3720	-	-	1	2.2	-	-
Plainsman	-	-	1	2.2	-	-
Preway/FB 24 FMC	-	-	1	2.2	-	-
Princess	1	1.2	-	-	-	-
Pyramid	-	-	1	2.2	-	-
Radiun/Evertz	-	-	-	-	1	2.2
Ram	1	1.2	-	-	-	-
Rancher	1	1.2	-	-	-	-
Scandia/180	-	-	1	2.2	-	-
Schrader	2	2.5	8	17.4	8	17.4
Sears Roebuck	6	7.5	1	2.2	2	4.3

* Percent of all wood stoves named in survey.

TABLE 3 (Cont.)

Brand/Model	Area A		Area B		Area C	
	Number	%*	Number	%*	Number	%*
Sherwood	1	1.2	-	-	-	-
Shop Stove	1	1.2	-	-	-	-
Sierra	-	-	1	2.2	-	-
Sigman	-	-	1	2.2	-	-
Starfire/FWS-39	-	-	-	-	1	2.2
Taiwan	-	-	-	-	1	2.2
Universal/Kitchen Range	1	1.2	-	-	-	-
Vermont/The Elm	-	-	-	-	1	2.2
Vulcan	1	1.2	-	-	-	-
Ward's	2	2.5	-	-	-	-
Washington Stove Works	1	1.2	3	6.5	-	-
Welcome	1	1.2	-	-	-	-
Western Flame	-	-	1	2.2	-	-
Westmont	-	-	-	-	1	2.2
Winwood Ind./36	-	-	1	2.2	-	-
TOTAL	80	-	46	-	46	-

* Percent of all wood stoves named in survey.

TABLE 4

Survey Results
Section II: Fireplaces and Fireplace Insert

Parameter	Average Values/Percentages (Number of Respondents)		
	Area A	Area B	Area C
Homes having one or more fireplaces	36.9% (100)	97.1% (368)	97.0% (423)
For households having a fireplace:			
Number of fireplaces			
1	82.8% (82)	39.1% (143)	17.3% (73)
2	16.2% (16)	51.4% (188)	75.5% (318)
3	1.0% (1)	9.3% (34)	6.9% (29)
4	--	0.3% (1)	0.2% (1)
Were any fireplaces used in the last 12 months:			
Yes	76.8% (76)	85.8% (313)	83.2% (347)
No	23.2% (23)	14.2% (52)	16.8% (70)
For households using a fireplace in the last 12 months:			
Wood burned in the last 12 months:	1.50 cords (74)	0.93 cords (307)	1.56 cords (336)
For households using a fireplace in February, 1981:			
Days in February fireplace used.	16.4 days (50)	8.91 days (245)	12.2 days (266)
On days in February fireplace used, hours per day wood was burned	7.62 hours (50)	4.16 hours (245)	6.32 hours (266)

TABLE 4 (Cont.)

Parameter	Average Values/Percentages (Number of Respondents)		
	Area A	Area B	Area C
For households using a fireplace in February, 1981:			
Kind of wood burned most often in each fireplace			
#1 Fireplace			
Softwood	56.1% (32)	19.6% (44)	85.4% (223)
Hardwood	35.1% (20)	69.8% (157)	5.0% (13)
Prepared wood (Prestolog)	3.5% (2)	6.2% (14)	7.7% (20)
Mixed	5.3% (3)	4.4% (10)	1.9% (5)
#2 Fireplace			
Softwood	60.0% (3)	11.6% (10)	86.0% (80)
Hardwood	20.0% (1)	75.6% (65)	6.5% (6)
Prepared wood (Prestolog)	20.0% (1)	8.1% (7)	4.3% (4)
Mixed	--	4.7% (4)	3.3% (3)
#3 Fireplace			
Softwood	--	--	50.0% (3)
Hardwood	--	71.4% (5)	16.7% (1)
Prepared wood (Prestolog)	--	28.6% (2)	16.7% (1)
Mixed	--	--	16.7% (1)
In past 12 months, amount of wood burned in fireplace(s)	2.13 cords (50)	1.25 cords (245)	1.95 cords (266)

TABLE 4 (Cont.)

Parameter	Average Values/Percentage (Number of Respondents)		
	Area A	Area B	Area C
What percentage of the wood burned in the past 12 months was burned in February?	22.7% (50)	13.9% (245)	12.6% (266)
For households using a fireplace in Feburary 1981:			
Fireplaces having a heat recirculating insert:			
#1	57.4% (35)	19.9% (54)	36.3% (107)
#2	12.5% (1)	7.1% (11)	16.8% (36)
#3	--	3.7% (1)	6.3% (1)

TABLE 5

Survey Results
Section III: Wood Burning Furnaces

Parameter	Average Values/Percentages (Number of Respondents)		
	Area A	Area B	Area C
Homes having wood burning furnace	1.6% (4)	0.6% (2)	1.3% (5)
For households having wood burning furnaces:			
Was it used in the last 12 months:			
Yes	100.0% (3)	50.0% (1)	16.7% (1)
No	--	50.0% (1)	83.3% (5)
For households using wood burning furnace in last 12 months:			
Wood burned in last 12 months.	4.0 cords (3)	0.1 cords (1)	3.0 cords (2)
For households using wood burning furnace in February, 1981:			
What percentage of wood burned in last 12 months was burned in February?	19.0% (3)	--	20.0% (1)
Days in February furnace used.	28 days (3)	--	27.5 days (2)
On days in February furnace used, hours per day.	15.67 hours (3)	--	13 hours (2)
Kind of wood burned most often:			
Softwood	100.0% (3)	--	100.0% (3)
Hardwood	--	--	--
Prepared Wood	--	--	--
Combination	--	--	--

TABLE 6

Survey Results
Section IV: Storage and Use of Firewood

Parameter	Average Values/Percentages (Number of Respondents)		
	Area A	Area B	Area C
How is firewood usually obtained:			
Purchased	28.7% (39)	49.2% (163)	39.0% (146)
Cut own	71.3% (97)	50.8% (168)	61.0% (228)
Month most of firewood obtained:			
January	1.0% (1)	0.8% (2)	--
February	3.9% (4)	0.8% (2)	0.6% (2)
March	--	2.5% (6)	--
April	--	4.5% (11)	0.6% (2)
May	10.7% (11)	4.1% (10)	1.3% (4)
June	6.8% (7)	7.0% (17)	1.9% (6)
July	12.6% (13)	10.7% (26)	5.8% (18)
August	18.4% (19)	17.7% (43)	14.7% (46)
September	22.3% (23)	23.5% (57)	39.9% (125)
October	14.6% (15)	17.3% (42)	24.3% (76)
November	8.7% (9)	5.8% (14)	6.1% (19)
December	--	2.1% (5)	1.3% (4)
Other (several months/ seasons)	1.0% (1)	3.3% (8)	3.5% (11)

TABLE 6 (Cont.)

Parameter	Average Values/Percentages (Number of Respondents)		
	Area A	Area B	Area C
When was wood cut that is now being burned:			
Less than 1 year ago	32.3% (43)	30.9% (101)	36.4% (135)
1 or more years ago	65.4% (87)	67.9% (222)	63.1% (234)
Both	2.3% (3)	1.2% (4)	0.5% (2)
Where is most firewood stored:			
Inside heated structure	4.9% (7)	4.2% (14)	7.6% (29)
Inside unheated structure	19.6% (28)	14.2% (48)	32.6% (125)
Outside but covered	42.7% (61)	55.2% (186)	40.1% (154)
Outside and uncovered	25.2% (36)	22.8% (77)	15.9% (61)
Other or multiple answer	7.7% (11)	3.6% (12)	3.9% (15)
Length of time firewood stored before use	11.8 months (118)	11.9 months (293)	10.6 months (328)
Was fuel other than wood used in woodburning unit?			
Yes	40.3% (58)	44.1% (150)	26.1% (100)
No	59.7% (86)	55.9% (190)	73.9% (283)
If other fuel was used, what was it?			
Oil	1.7% (1)	1.3% (2)	1.0% (1)
Trash	6.9% (4)	6.7% (10)	6.0% (6)

TABLE 6 (Cont.)

Parameter	Average Values/Percentages (Number of Respondents)		
	Area A	Area B	Area C
If other fuel was used, what was it (Cont.):			
Paper, cardboard	74.1% (43)	54.7% (82)	33.0% (33)
Prestologs	13.8% (8)	23.3% (35)	53.0% (53)
Coal	3.4% (2)	8.0% (12)	3.0% (3)
Gas	--	5.3% (8)	4.0% (4)
Other	--	0.7% (1)	--
Anticipated amount of wood burned 1981-82 compared to 1980-81:			
More	31.9% (46)	27.8% (92)	27.7% (104)
Less	9.0% (13)	11.5% (38)	9.3% (35)
Same	59.0% (85)	60.7% (201)	62.9% (236)
Amount of wood anticipated to be burned in 1981-82 (for all households including non-woodburning)	1.1 cords (274)	1.4 cords (349)	2.2 cords (406)
Reason for change in wood use - see Tables 7-8			
Wood use in 1979-80 compared to 1980-81:			
Less in 1979-80	21.8% (29)	25.4% (84)	24.0% (88)
More in 1979-80	29.3% (39)	21.8% (72)	26.5% (97)
Same	39.8% (53)	52.0% (172)	46.7% (171)
Did not reside at same address	9.0% (12)	0.9% (3)	2.7% (10)

TABLE 7

Survey Results
Reasons for Anticipated Decrease in Wood Use
1981-1982*

Reason	Area A		Area B		Area C	
	Number	%	Number	%	Number	%
Cost/availability of firewood	2	16.7	16	37.2	11	28.2
Too much trouble/ too dirty	1	8.3	4	9.3	4	10.3
Improved efficiency of unit/operating practices or installed fireplace insert	2	16.7	2	4.7	5	12.8
Use other heat source instead	-	-	2	4.7	1	2.6
Switch to coal	-	-	1	2.3	1	2.6
Wood burning is too inefficient	-	-	11	25.6	7	17.9
Too much smoke inside/ outside	-	-	2	4.7	-	-
Change in living pattern	2	16.7	4	9.3	6	15.4
Insulated house	3	25.0	-	-	1	2.6
Expecting warmer weather	1	8.3	-	-	-	-
Other	1	8.3	1	2.3	3	7.7

*Respondents filled in their own reasons. The answers were put into categories during the coding process and further categorized for this table.

TABLE 8

Survey Results
Reasons for Anticipated Increase in Wood Use
1981-1982

Reason	Area A		Area B		Area C	
	Number	%	Number	%	Number	%
Cost/availability of firewood	5	10.0	18	18.2	23	20.7
Cost/need to conserve oil, gas, electricity	5	10.0	27	27.3	14	12.6
Change in living pattern	-	-	7	7.1	3	2.7
Want more heat/building more rooms/want to use more often/have repaired unit	4	8.0	12	12.1	6	5.4
Weather more severe next year	17	34.0	11	11.1	29	26.1
Will get more wood next year	8	16.0	7	7.1	6	5.4
Enjoy fires	-	-	7	7.1	1	0.9
Quality of wood heat	1	2.0	-	-	-	-
Install new unit(s)	5	10.0	9	9.1	28	25.2
Other	5	10.0	1	1.0	1	0.9

TABLE 9

Survey Results
Section Va: Plans for Additional Wood Burning Units

Parameter	Average Values/Percentages (Number of Respondents)		
	Area A	Area B	Area C
Plan to buy wood burning stove			
Yes	13.6% (38)	9.1% (34)	6.1% (26)
No	86.4% (241)	90.9% (340)	93.9% (399)
If planning to buy wood burning stove:			
Number of months until purchase:	11 months (30)	10 months (29)	9 months (23)
Buy more than one			
Yes	5.6% (2)	5.9% (2)	7.7% (2)
No	94.4% (34)	94.1% (32)	92.3% (24)
How many (if more than one)			
2	50.0% (1)	100.0% (2)	100.0% (2)
4	50.0% (1)	--	--
Plan to buy fireplace insert			
Yes	6.0% (15)	17.9% (68)	16.5% (70)
No	94.0% (234)	82.1% (311)	83.5% (355)

TABLE 9 (Cont.)

Parameter	Average Values/Percentages (Number of Respondents)		
	Area A	Area B	Area C
If planning to buy fireplace insert:			
Time until purchase:	8 months (12)	8 months (61)	8 months (59)
Buy more than one			
Yes	7.1% (1)	4.8% (3)	10.1% (7)
No	92.9% (13)	95.2% (60)	89.9% (62)
How many (if more than one)			
2	100.0% (1)	66.7% (2)	100.0% (7)
3	--	33.3% (1)	--
Plan to install fireplace:			
Yes	2.6% (7)	1.4% (5)	0.8% (3)
No	97.4% (260)	98.6% (361)	99.2% (393)
If planning to install fireplace:			
Time until installation:	16 months (5)	12 months (4)	3 months (1)
Install more than 1			
Yes	0%	0%	0%
No	100% (8)	100% (4)	100% (1)

TABLE 10

Survey Results
Section Vb: General Household Information

Parameter	Average Values/Percentages (Number of Respondents)		
	Area A	Area B	Area C
Main source of home heating:			
Natural Gas	29.2% (84)	57.8% (219)	74.1% (326)
Electricity	29.2% (84)	14.8% (56)	7.5% (33)
Oil	20.8% (60)	18.2% (69)	7.5% (33)
Wood	14.2% (41)	5.8% (22)	5.0% (22)
Wood and other	5.9% (17)	2.4% (9)	3.9% (17)
More than one	0.7% (2)	1.1% (4)	1.8% (8)
Coal	--	--	0.2% (1)
Years residing at address:			
Less than 1 year	2.1% (6)	0.5% (2)	0.7% (3)
1 - 2 years	18.1% (52)	10.3% (39)	9.1% (40)
3 - 4 years	12.5% (36)	16.6% (63)	11.1% (49)
5+ years	67.4% (194)	72.6% (276)	79.1% (349)
Owner or renter:			
Owner	84.0% (242)	96.0% (360)	95.6% (416)
Renter	16.0% (46)	4.0% (15)	4.4% (19)
Year average dwelling built	1945 (187)	1962 (307)	1961 (343)

TABLE 10 (Cont.)

Parameter	Average Values/Percentages (Number of Respondents)		
	Area A	Area B	Area C
Type of residence			
Single family home	96.9% (278)	99.5% (373)	94.3% (412)
Duplex	2.1% (6)	--	5.3% (23)
Condominium	--	--	0.2% (1)
Apartment	1.0% (3)	--	0.2% (1)
Mobile Home	--	0.5% (2)	--
Size of residence (excluding garage)	1404 sq. ft. (206)	2311 sq. ft. (361)	1719 sq. ft. (407)
Rooms heated			
All rooms	54.9% (140)	43.2% (150)	62.5% (257)
Close some off	45.1% (115)	56.8% (197)	37.5% (154)
% of house not heated (if any closed off)	34.0% (115)	29.1% (197)	30.9% (154)
Types of insulation			
Above ceiling or below roof			
Yes	89.4% (245)	93.7% (340)	98.8% (426)
No	10.6% (29)	6.3% (23)	1.2% (5)
First floor walls			
Yes	54.4% (124)	79.5% (280)	87.1% (350)
No	45.6% (104)	20.5% (72)	12.9% (52)

TABLE 10 (Cont.)

Parameter	Average Values/Percentage (Number of Respondents)		
	Area A	Area B	Area C
Types of insulation(cont.)			
Storm or double glazed windows			
Yes	72.9% (188)	40.8% (141)	91.8% (392)
No	27.1% (70)	59.2% (205)	8.2% (35)
Storm or double glazed doors			
Yes	64.9% (161)	34.9% (116)	89.0% (374)
No	35.1% (87)	65.1% (216)	11.0% (46)
Weather stripping or caulking			
Yes	75.2% (191)	82.3% (292)	85.3% (347)
No	24.8% (63)	17.7% (63)	14.7% (60)
Insulation of ground floor, basement, or attached garage			
Yes	42.2% (98)	59.8% (204)	51.0% (201)
No	57.8% (134)	40.2% (137)	49.0% (193)
Normal number of inhabitants	2.5 people (285)	3.1 people (374)	3.0 people (437)

TABLE 10 (Cont.)

Parameter	Average Values/Percentage (Number of Respondents)		
	Area A	Area B	Area C
Occupation of head of household			
Science, Adminstrative, Teacher	15.7% (37)	63.2% (218)	40.0% (146)
Clerical, Technician, Sales	22.9% (54)	21.7% (75)	31.0% (113)
Service, Military	8.9% (21)	3.8% (13)	5.8% (21)
Farm, Forest	1.3% (3)	1.2% (4)	1.4% (5)
Production	51.3% (121)	10.1% (35)	21.9% (80)
Highest education level of head of household			
Grammar school	8.3% (23)	0.8% (3)	2.4% (10)
Some high school	20.5% (57)	2.1% (8)	5.9% (25)
High school graduate	26.3% (73)	12.5% (47)	20.3% (86)
Some college	27.3% (76)	18.9% (71)	31.9% (135)
College graduate	9.7% (27)	61.6% (231)	31.2% (132)
Trade school graduate	7.9% (22)	4.0% (15)	8.3% (35)
Age of head of household			
Under 25	2.5% (7)	0.3% (1)	0.7% (3)
25 - 34	20.3% (57)	10.6% (40)	7.0% (30)
35 - 44	13.5% (38)	23.3% (88)	21.6% (93)

TABLE 10 (Cont.)

Parameter	Average Values/Percentages (Number of Respondents)		
	Area A	Area B	Area C
Age of head of household			
45 - 54	12.1% (34)	28.6% (108)	27.4% (118)
55 - 64	22.1% (62)	28.9% (109)	25.8% (111)
65+	29.5% (83)	8.2% (31)	17.4% (75)
1980 household income before taxes			
Less than $10,000	28.4% (75)	2.3% (8)	8.6% (34)
$10,000 - 19,999	36.0% (95)	11.6% (41)	17.7% (70)
$20,000 - 29,999	25.4% (67)	22.7% (80)	34.8% (138)
$30,000 - 39,999	8.0% (21)	23.5% (83)	23.0% (91)
$40,000 - 49,999	1.1% (3)	17.6% (62)	9.8% (39)
$50,000+	1.1% (3)	22.4% (79)	6.1% (24)

TABLE 11

Summary of Demographic Information

Parameter	Area A	Area B	Area C
Predominant type of home	Single family residence (96.9%)	Single family residence (99.5%)	Single family residence (94.3%)
% home ownership	84.0%	96.0%	95.6%
Average size of home	1404 sq. ft.	2311 sq. ft.	1719 sq. ft.
Average household income	$18,400	$35,000	$27,700
Average year home built	1945	1962	1961
Predominant occupation	Production (51.3%)	Science, teacher, administrative (63.2%)	Science, teacher, administrative (40.0%)
Average education level in years (head of household)	12.4 yrs.	14.8 yrs.	13.8 yrs.
Average age (head of household)	50.6 yrs.	49.5 yrs.	51.4 yrs.
Average number of people in household	2.5 people	3.1 people	3.0 people

TABLE 12

Summary of Wood Use
by
Type of Woodburning Device

Parameter	Area A	Area B	Area C
Households surveyed:			
-All households	288	380	443
-Woodburning-households	143	321	353
-Woodstove-using households	78	45	46
-Fireplace-using households	76	313	347
-Furnace-using households	3	1	1
Households using wood as primary heat source:			
-Woodstove/furnace-using households	38	15	11
-Fireplace-(no inserts) using households	2	5	3
-Insert-using households	4	7	12
Households using wood as secondary heat source:			
-Woodstove/furnace-using households	42	31	36
-Fireplace-(no inserts) using households	39	244	218
-Insert-using households	31	56	113
Total wood burned:			
-All households	1.0 cords/yr	1.0 cord/yr	1.6 cords/yr
-Woodburning households	2.0 cords/yr	1.2 cords/yr	1.9 cords/yr
Wood burned in wood stoves			
-All households	0.6 cords/yr	0.3 cords/yr	0.3 cords/yr
-Woodstove - using households	2.1 cords/yr	2.1 cords/yr	3.4 cords/yr

TABLE 12 (Cont.)

Parameter	Area A	Area B	Area C
Wood burned in fireplace			
-All households	0.4 cords/yr	0.8 cords/yr	1.2 cords/yr
-Fireplace-using households	1.5 cords/yr	0.9 cords/yr	1.5 cords/yr
Wood burned in furnaces			
-All households	0.04 cords/yr	0 cords/yr	0.01 cords/yr
-Furnace - using households	4.0 cords/yr	0.1 cords/yr	5.0 cords/yr
Wood burned in stove or furnace - using households			
-Wood as primary heat source	2.8 cords/yr	3.2 cords/yr	5.0 cords/yr
-Wood as secondary heat source	1.7 cords/yr	1.6 cords/yr	3.0 cords/yr
Wood burned in fireplace using households (no inserts)			
-Wood as primary heat source	5.2 cords/yr	1.4 cords/yr	2.4 cords/yr
-Wood as secondary heat source	0.9 cords/yr	0.7 cords/yr	0.9 cords/yr
Wood burned in fireplace using households (with inserts)			
-Wood as primary heat source	2.0 cords/yr	2.9 cords/yr	4.3 cords/yr
-Wood as secondary heat source	1.9 cords/yr	1.6 cords/yr	2.3 cords/yr
Wood burned in February:			
-Total survey area* - all devices	433.6 cords	303.7 cords	320.5 cords
-Total survey area* - wood stoves	214.0 cords	56.4 cords	63.9 cords
-Per household** - all devices	0.57 cords	0.26 cords	0.48 cords
-Per household** - wood stoves	0.52 cords	0.43 cords	0.89 cords

* Includes all households in the survey area, but those households surveyed and those that were not. These are projections based on the households surveyed.

** "Household" refers to households surveyed.

TABLE 13

Annual Wood Use (1980 - 81)
Significant Relation to Demographic & Wood Usage Variables*

Variable/Area	Mean - Cords wood burned/ yr/household	Number (N)	Standard Deviation
Education Area B			
Not H.S. graduate	2.4	11	2.81
H.S. or Trade school grad.	1.3	130	1.33
College graduate	0.8	224	1.04
Age Area C			
<35	2.0	31	2.1
35 - 44	1.9	88	2.5
45 - 54	1.8	112	2.1
55 - 64	1.1	106	1.4
≥65	1.2	73	1.5
Income Area A			
<20,000	0.8	168	1.3
20,000 - 29,999	1.5	67	2.1
30,000 - 39,999	1.3	21	2.4
40,000 - more	1.0	6	0.8
Income Area B			
<20,000	1.3	47	1.3
20,000 - 29,999	1.5	79	1.8
30,000 - 39,999	1.0	79	1.0
40,000 - more	0.8	139	1.0
Home Size Area B			
<1500	1.5	80	1.6
1501 - 2500	1.0	130	1.3
>2500	0.7	143	0.8
Wood Storage Location Area B			
Enclosed	0.8	60	1.4
Outside, covered	1.3	180	1.3
Outside, uncovered	0.8	76	1.0

* Significant at the .05 level

TABLE 13 (Cont.)

Variable/Area	Mean - Cords wood burned/ yr/household	Number (N)	Standard Deviation
Wood Storage Location Area C			
Enclosed	1.3	148	2.0
Outside, covered	2.3	148	2.2
Outside, uncovered	1.7	58	2.1
When wood cut Area A			
<1 year ago	1.6	98	1.3
≥1 year ago	0.9	216	1.1
When Wood Cut Area C			
<1 year ago	2.8	127	2.4
≥1 year ago	1.1	227	1.4
Chop own or Purchase Area A			
Purchase precut	1.2	39	1.0
Chop own	2.3	95	2.1
Chop own or Purhcase Area B			
Purchase precut	0.9	156	1.2
Chop own	1.3	166	1.4
Chop own or Purchase Area C			
Purchase precut	1.2	140	1.6
Chop own	2.1	218	2.1

TABLE 14

Cross Tabulation of Important Parameter Tables
with
Chi-square Tests Significant at Level .05 or Less

Expected Wood Use 1981-82

	Area A			Area B		
	Less	Same	More	Less	Same	More
AGE						
<35	2	16	17	5	11	20
35 - 44	5	12	5	7	51	21
45 - 54	2	10	7	12	56	28
55 - 64	3	18	11	8	65	19
≥65	1	26	5	6	17	3

Storage of Wood - Location

	Area B		
	Enclosed	Outside, covered	Outside, uncovered
AGE			
<35	2	27	7
35 - 44	11	48	16
45 - 54	20	59	15
55 - 64	21	41	31
≥65	7	11	7

TABLE 14 (Cont.)

Plans to Buy New Stove

Area C

	Yes	No
AGE		
<35	7	26
35 - 44	11	77
45 - 54	6	110
55 - 64	2	107
≥65	0	70

Plans to Buy New Stove

Area C

	Yes	No
AREA HOME Sq. Feet		
<1501	8	208
1501 - 2500	10	128
>2500	7	34

TABLE 15

Statistical Data on Key Parameters

Parameter/City	Mean	Number (N)	Standard Deviation	Standard * Error
Total cords wood burned/ year/all households				
Area A	1.0	284	1.6	0.098
Area B	1.0	370	1.3	0.066
Area C	1.6	423	2.1	0.100
Total cords wood burned/ year/woodburning household				
Area A	2.0	143	1.9	0.155
Area B	1.2	321	1.3	0.072
Area C	1.9	353	2.1	0.113
Cords wood burned in woodstoves/year/all households				
Area A	0.6	286	1.2	0.071
Area B	0.3	379	0.9	0.046
Area C	0.3	439	1.4	0.065
Cords wood burned in woodstoves/year/wood-stove-using household				
Area A	2.1	76	1.5	0.167
Area B	2.1	45	1.6	0.244
Area C	3.4	45	2.9	0.426
Cords wood burned in fireplaces/year/all households				
Area A	0.4	286	1.1	0.065
Area B	0.8	370	1.1	0.056
Area C	1.2	425	1.6	0.078

* To calculate the approximate 95% confidence interval, multiply the standard error by 2. See page 7 of the text for a discussion of the confidence interval.

TABLE 15 (Cont.)

Parameter/City	Mean	Number (N)	Standard Deviation	Standard * Error
Cords wood burned in fireplaces/year/fire-place-using household				
Area A	1.5	74	1.7	0.201
Area B	0.9	307	1.1	0.064
Area C	1.5	336	1.6	0.087
Cords wood burned in furnace/year/all households				
Area A	0.04	288	0.5	0.027
Area B	0.00	380	0.005	0.000
Area C	0.01	442	0.24	0.012
Cords wood burned in furnace/year/furnace users				
Area A	4.0	3	2.6	1.528
Area B	0.1	1	0.0	0.0
Area C	5.0	1	0.0	0.0
Expected cord wood use 1981-82 for all households				
Area A	1.1	274	1.7	0.101
Area B	1.4	349	1.5	0.081
Area C	2.2	406	3.2	0.159
Cords wood burned in woodstoves in February, all households, X 100				
Area A	10.3	262	33.3	2.059
Area B	3.9	368	16.6	0.865
Area C	6.9	427	36.8	1.781

* To calculate the approximate 95% confidence interval, multiply the standard error by 2. See page 7 of the text for a discussion of the confidence interval.

TABLE 15 (Cont.)

Parameter/City	Mean	Number (N)	Standard Deviation	Standard * Error
Cords wood burned in fireplaces in February, all households, X 100				
Area A	7.9	246	31.0	1.976
Area B	15.9	249	24.3	1.539
Area C	24.6	264	43.7	2.690
Cords wood burned in furnaces in February, all households, X 100				
Area A	0.7	288	6.7	0.397
Area B	0.0	379	0.0	0.0
Area C	0.2	441	4.8	0.227

* To calculate the approximate 95% confidence interval, multiply the standard error by 2. See page 7 of the text for a discussion of the confidence interval.

TABLE 16
Comparison of Portland Survey
with
Other Recent Surveys

Parameter	Current Study	BPA Study[1]	DEQ Study (Talbott Wong)[2]
Area surveyed	1 sq. mile, Portland	State of Oregon	Portland AQMA
Number surveyed	288	1,156	400
Date of survey	5/81	12/80	mid-1979
% single family dwellings	97%	---	75%
Annual wood usage -- all households	1.0 cords	---	0.7 cords[4]
Annual wood usage -- wood burning households	2.0 cords	2.6 cords[3]	1.5 cords
% households with wood stoves	31.7%	---	10%[4]
% households with fireplaces	36.9%	---	35%[4]
% households using wood as a primary source of heat	14.2%	14.5%	4.5%
Wood storage location			
Inside, heated	4.9%	---	21.4%
Inside, unheated	19.6%	---	37.2%
Outside, covered	42.7%	---	36.7%
Outside, uncovered	25.2%	---	4.7%
Other or multiple answer	7.7%	---	---

1 Pacific Northwest Residential Energy Survey, July 1980. Conducted by Elrick & Lavidge, Inc. under contract to the Bonneville Power Administration.

2 Impact of Fuel Conversions on Air Quality in Oregon's Air Quality Maintenance Areas, 12/80. Talbott Wong & Associates on contract to the Oregon Department of Environmental Quality.

3 Not limited to single family dwellings.

4 Note that 25% of households surveyed were not single family dwellings and, therefore, will probably have fewer woodburning units and burn less wood.

TABLE 16 (Cont.)

Parameter	Current Study	BPA Study[1]	DEQ Study (Talbott Wong)[2]
% of house unheated (closed off)	34%	8%	---
Type of wood burned			
Softwood	61.1%[3]	---	48.4%
Hardwood	25.0%[3]	---	31.3%
Prestologs	4.2%[3]	---	8.4%
Mixed	9.7%[3]	---	---

[1] Pacific Northwest Residential Energy Survey, July 1980. Conducted by Elrick & Lavidge, Inc. under contract to the Bonneville Power Administration.

[2] Impact of Fuel Conversions on Air Quality in Oregon's Air Quality Maintenance Areas, 12/80. Talbott Wong & Associates on contract to the Oregon Department of Environmental Quality.

[3] Question asked only of those burning wood in February 1981 in wood stove.

TABLE 17

Comparison of Seattle Survey
with
Other Recent Surveys

Parameter	Current Study	BPA Study[1]	Puget Sound P&L Study[2]
Area surveyed	1 sq. mile, Bellevue	State of Washington	Service area-NW Washington[3]
Number surveyed	380	1,467	338
Date of survey	5/81	12/80	8/80
% single family dwellings with wood stove	13.5%	---	25.1%
% single family dwellings with fireplace	97.1%	---	57.5%
% single family dwellings with no wood burning device	1.3%	---	17.4%
% of all households using wood as primary heat source	5.8%	7.6%	11.7%[4]
Wood burned annually -- wood burning household	1.9 cords	2.0 cords	1.7 cords
Wood burned annually -- wood stove users	2.1 cords	---	2.4 cords
Wood burned annually -- fireplace users	1.5 cords	---	1.4 cords
Cut own firewood (% of total used)	50.8%	---	61.9%
% house unheated (closed off)	29.1%	7%	---

[1] Pacific Northwest Residential Energy Survey, July, 1980. Conducted by Elrick & Lavidge, Inc. under contract to the Bonneville Power Administration.

[2] Residential Wood Heating Survey, July, 1980. Puget Sound Power & Light Co.

[3] The Puget Sound P & L service area occupies part of the northwest third of the state, and is characterized as largely suburban and rural.

[4] Calculated by DGA from % of households burning wood times % of wood burning households using wood as primary heat sources.

TABLE 18

Comparison of Spokane Survey
with
Other Recent Surveys

Parameter	Current Study	BPA Study[1]
Area surveyed	1 sq. mile, Spokane	State of Washington
Number surveyed	443	1,467
Date of survey	5/81	12/80
Wood burned annually -- wood burning households	1.9 cords	2.0 cords
% households using wood as a primary heat source	5.0%	7.6%
% of house unheated (closed off)	31%	7%

[1] Pacific Northwest Residential Energy Survey, July, 1980. Conducted by Elrick & Lavidge, Inc. under contract to the Bonneville Power Administration.

APPENDIX A

Questionnaire

"Study of Woodburning Equipment for Home Heating as an Alternative Energy Source"

Notes on Questionnaire

Some responses to questions 3i and 4i were treated as "missing" when it was obvious the respondent had misunderstood the question (see page 5). Question 4b was not used in data analsyis. This question asked that each fireplace be identified by the room (to be written in by the respondent). This question was intended to assist in the editing of the questionnaires, only.

STUDY OF WOOD BURNING EQUIPMENT FOR HOME HEATING AS AN ALTERNATIVE ENERGY SOURCE

Please complete the following questionnaire as accurately as possible. If you do not know the answer to a question please make an effort to find it out, either by asking another member of your household or simply checking around your house. Your cooperation is very important to the success of the study.

If you do not live at the address shown on the letter enclosed, please check here ☐ and do not complete the questionnaire. Please return the uncompleted questionnaire in the enclosed self-addressed, stamped envelope.

Please read each question carefully and then put a check ☑ in the box next to your answer.

1. How long have you lived at the address shown on the enclosed letter?

   a. Less than 1 year? . . . . . ☐
   b. 1 to 2 years? . . . . . ☐
   c. 3 to 4 years? . . . . . ☐
   d. 5 years or more? . . . . . ☐

2. Do you use natural gas, propane, electricity, oil, coal, wood, or something else as your main source of home heating?

   (Please check ONE answer)

   a. Natural gas . . . ☐
   b. Propane . . . . . ☐
   c. Electricity . . . ☐
   d. Oil . . . . . ☐
   e. Coal . . . . . ☐
   f. Wood . . . . . ☐
   g. Something else (PLEASE NAME):

   _____

SECTION I

Wood Burning Stoves (Free Standing)

3. If there is one or more wood burning stoves in your home, please check here ☐ and complete this section.

(OR)

If there are no wood burning stoves in your home, please check here ☐ and skip to Page 4, Section II, called "Fireplaces and Fireplace Inserts."

3a. How many wood burning stoves are there in your home?_____

3b. Please list all the wood stoves you have by brand name and model. (If you have more than one stove of the same brand name and model, please list each one separately.)

	Brand Name	Model
1.		
2.		
3.		

3c. Did you use (any of) your wood stove(s) during the last 12 months?

Yes ☐ → (continue)

No ☐ → IF NO, SKIP TO PAGE 4, SECTION II

3d. (IF YES to Question 3c) During the last 12 months how many cords of wood, or what fraction of a cord, did you burn in your wood stove(s)? (A cord of wood is a stack of wood four feet high, eight feet long, and four feet wide.)

_____(cords)

If you used (any of) your wood stove(s) during the month of February 1981, please answer the following questions for each stove. (If you did not use (any of) your wood stove(s) during the month of February 1981, please skip to Page 4, Section II.) Each answer should refer to your list of wood stoves in Question 3b, so your following answers on the lines marked 1. will apply to the specific stove you listed on line 1. in Question 3b, and so on.

3e. During the month of February of this year, approximately how many days did you use each of your wood stoves?

1. _____(days in February)

2. _____(days in February)

3. _____(days in February)

3f. On the days you used your stove(s) during February 1981, about how many hours per day did you burn wood in each stove?

1. _____(hours per day)

2. _____(hours per day)

3. _____(hours per day)

(PLEASE GO ON TO NEXT PAGE)

3g. During the same time period, what kind of wood did you burn most often in each stove, softwoods (such as fir or cedar), hardwoods (such as alder, oak, or maple), prepared woods (such as presto-logs), or something else?

(Please name ONE kind of wood burned MOST OFTEN in each stove)

1. _____

2. _____

3. _____

3h. During the last 12 months, how many cords of wood, or what fraction of a cord, did you burn in each stove?

1. _____(cords)

2. _____(cords)

3. _____(cords)

3i. What percent (%) of that wood (your answer(s) to Question 3h) did you burn in each stove during February 1981?

1. _____(% burned in February)

2. _____(% burned in February)

3. _____(% burned in February)

(PLEASE GO ON TO NEXT PAGE)

SECTION II

Fireplaces and Fireplace Inserts

4. If you have one or more fireplaces in your home, please check here ☐ and complete this section.

(OR)

If you do not have a fireplace in your home, please check here ☐ and skip to Page 6, Section III, called "Wood Burning Furnaces."

4a. How many fireplaces are there in your home? _____

4b. Please list all the fireplaces you have by the name of the room in which they are located.

Name of Room

1. _____
2. _____
3. _____

4c. Did you use (any of) your fireplace(s) during the last 12 months?

Yes ☐ ↓

No ☐ ↓ IF NO, SKIP TO PAGE 6, SECTION III

4d. (IF YES to Question 4c) During the last 12 months, how many cords of wood, or what fraction of a cord, did you burn in your fireplace(s)? (A cord of wood is a stack of wood four feet high, eight feet long, and four feet wide.)

_____(cords)

If you used any of your fireplace(s) during the month of February 1981, please answer the following questions for each fireplace. (If you did not use (any of) your fireplaces(s) during the month of February 1981, please skip to Page 6, Section III.) Each answer should refer to your list of fireplaces in Question 4b, so your following answers on the lines marked 1. will apply to the specific fireplace you listed on line 1. in Question 4b, and so on.

4e. During the month of February of this year, approximately how many days did you use each of your fireplaces?

1. _____(days in February)
2. _____(days in February)
3. _____(days in February)

4f. On the days you used your fireplace(s) during February 1981 about how many hours per day did you burn wood in each fireplace?

1. _____(hours per day)
2. _____(hours per day)
3. _____(hours per day)

(PLEASE GO ON TO NEXT PAGE)

4g. During the same time period, what kind of wood did you burn most often in each fireplace, softwoods (such as fir or cedar), hardwoods (such as alder, oak, or maple), prepared woods (such as presto-logs), or something else?

(Please name ONE kind of wood burned MOST OFTEN in each fireplace)

1. _____

2. _____

3. _____

4h. During the last 12 months, how many cords of wood, or what fraction of a cord, did you burn in each fireplace?

1. _____(cords)

2. _____(cords)

3. _____(cords)

4i. What percent (%) of that wood (your answer(s) to Question 4h) did you burn in each fireplace during February 1981?

1. _____(% burned in February)

2. _____(% burned in February)

3. _____(% burned in February)

4j. Do any of your fireplaces have a heat recirculating insert, such as a heat-o-later? (Please answer for each fireplace listed.)

1. Yes ☐ No ☐

2. Yes ☐ No ☐

3. Yes ☐ No ☐

(PLEASE GO ON TO NEXT PAGE)

SECTION III

Wood Burning Furnaces

5. If there is a furnace in your home, in which you burn wood, please check here ☐ and complete this section.

(OR)

If you do not have a wood burning furnace in your home, please check here ☐ and skip to Page 7, Section IV, called, "Storage and Use of Firewood."

5a. Did you burn wood in your furnace during the last 12 months?

Yes ☐ No ☐

IF NO, SKIP TO PAGE 7, SECTION IV

5b. (IF YES to Question 5a) During the last 12 months how many cords of wood, or what fraction of a cord, did you burn in your furnace? (A cord of wood is a stack of wood four feet high, eight feet long, and four feet wide.)

_____(cords)

If you burned wood in your furnace during the month of February 1981, please answer the following questions. (If you did not burn wood in your furnace during the month of February 1981, please skip to Page 7, Section IV.)

5c. What percent (%) of that wood (your answer to Question 5b) did you burn in your furnace during February 1981?

_____(% burned in February)

5d. During the month of February of this year, approximately how many days did you burn wood in your furnace?

_____(days in February)

5e. On the days you burned wood in your furnace during February 1981, about how many hours per day did you burn wood in your furnace?

_____(hours per day)

5f. During the same time period, what kind of wood did you burn most often in your furnace, softwoods (such as fir or cedar), hardwoods (such as alder, oak, or maple), prepared woods (such as presto-logs), or something else?

(Please name ONE kind of wood burned MOST OFTEN)

_____

(PLEASE GO ON TO NEXT PAGE)

SECTION IV

Storage and Use of Firewood

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If you have a wood burning stove, fireplace, or wood burning furnace, in your home, please complete this section.

(OR)

If you do not have any wood burning facilities in your home, please skip to Page 9, Section V, called "General Household Information."

6. Do you usually purchase precut firewood or do you chop your own firewood?

(Please check ONE)

a. Purchase precut firewood, or . . . . . ☐

b. Chop your own firewood? . . . . . ☐

7. What month of the year do you usually obtain most of your firewood?

_____

8. Are you burning wood that was cut less than one year ago, or one or more years ago?

(Please check ONE)

a. Cut less than one year ago, or . . . . . ☐

b. Cut one or more years ago? . . . . . ☐

9. Do you store most of your firewood....

(Please check ONE)

a. Inside your home or a heated garage? . . . . ☐

b. In an enclosed but unheated garage or shed? . . . . . ☐

c. Outside in a covered location?, or . . . . . ☐

d. Outside and uncovered? . ☐

10. How long would you say you store your firewood before burning it?

_____

11. Do you burn anything else, other than wood, in your wood stove, fireplace, or furnace?

Yes ☐ No ☐

(IF YES) What besides wood do you burn? _____

(PLEASE GO ON TO NEXT PAGE)

12. Given the current price and availability of wood and other fuels, do you think you will burn less wood, the same amount of wood, or more wood, <u>during the next heating season, 1981-82</u>?

a. Less Wood . . . . . ☐

↓

(IF LESS) Why will you burn less wood?_____

_____

_____

_____

b. Same Amount of Wood . . . ☐

c. More Wood . . . . . ☐

↓

(IF MORE) Why will you burn more wood?_____

_____

_____

_____

13. <u>In total</u>, how many cords of wood, or what fraction of a cord, do you think you will burn <u>next heating season</u> (1981-82)?

_____(cords)

--. Now thinking about the <u>previous heating season, that is 1979-80</u>, in your present residence did you burn less wood, the same amount of wood, or more wood than this winter?

a. Less Wood . . . . . ☐

↓

(IF LESS) How much wood did you burn during the heating season of 1979-80?

_____

b. Same Amount of Wood . . ☐

c. More Wood . . . . . ☐

↓

(IF MORE) How much wood did you burn during the heating season of 1979-80?

_____

d. Did not reside at present address in 1979-80 . . . . . ☐

(PLEASE GO ON TO NEXT PAGE)

SECTION V

General Household Information

Please answer the questions in this section EVEN IF you do not have a wood burning stove, fireplace, or wood burning furnace in your home.

15. Do you have any plans for buying a (another) wood burning stove for your present residence?

Yes ☐ No ☐

(IF YES, ANSWER Questions 15a and 15b)

15a. (IF YES) How soon do you think you might purchase one?

_____

15b. Do you foresee buying more than one?

Yes ☐ No ☐

↓

(IF YES) How many do you think you might buy?

_____

16. Do you have any plans for buying a (another) fireplace insert for your present residence?

Yes ☐ No ☐

(IF YES, ANSWER Questions 16a and 16b)

16a. (IF YES) How soon do you think you might purchase one?

_____

16b. Do you foresee buying more than one?

Yes ☐ No ☐

↓

(IF YES) How many do you think you might buy?

_____

(PLEASE GO ON TO NEXT PAGE)

17. Do you have any plans for buying a fireplace for your present residence?

Yes ☐ No ☐

(IF YES, ANSWER Questions 17a and 17b)

17a. (IF YES) How soon do you think you might purchase one?

_____

17b. Do you foresee buying more than one?

Yes ☐ No ☐

(IF YES) How many do you think you might buy?

_____

18. Do you own or rent your residence?

a. Own . . . . . ☐

b. Rent . . . . . ☐

19. In what year was your dwelling built?

_____

20. Is your residence a....?

a. Single family home, . . ☐

b. Duplex, ... ☐

c. Condominium, ... ☐

d. Apartment or . . . . . ☐

Something Else (Please Name)

_____

21. What is the square footage of your residence (excluding the garage)?

_____

22. Do you heat all the rooms in your home [illegible] during the season?

a. Heat All Rooms . . . . ☐

b. Close Some Off . . . . ☐

(IF CLOSE SOME OFF) What percent (%) of your house do you not heat?

_____

23. Do you have any of the following types of insulation in your residence.

a. Insulation above the ceiling or on the underside of the roof? . . . . Yes ☐ No ☐

b. Insulation on the first floor walls? Yes ☐ No ☐

c. Storm or double glazed windows? . Yes ☐ No ☐

d. Storm or double glazed doors? . . Yes ☐ No ☐

e. Weather stripping or caulking?, or Yes ☐ No ☐

f. Insulation on the ground floor, basement, or attached garage? . . . . . Yes ☐ No ☐

24. How many [illegible] in your home.

25. What is the occupation of the head of your household? (If no head of household, list occupations of all adults in your household. If retired or disabled, please state former occupation.)

_____

_____

26. What is the highest level of education reached by the head of the household? (If no head of household, check highest level of education for all adults contributing to household income.)

a. Grammar School . . . . ☐
b. Some High School . . . ☐
c. High School Graduate . . ☐
d. Some College . . . . . ☐
e. College Graduate . . . . ☐
f. Trade School Graduate . . ☐

27. Which of the following categories includes the age of the head of the household? (If no head of household, check [illegible])

a. Under 25 . . . . . ☐
b. 25-34 . . . . . ☐
c. 35-44 . . . . . ☐
d. 45-54 . . . . . ☐
e. 55-64 . . . . . ☐
f. 65 And Over . . . . . ☐

28. Check the box in the category that includes your household's 1979 income, before taxes.

a. Less than $10,000 . . ☐
b. $10,000 to $19,999 . . ☐
c. $20,000 to $29,999 . . ☐
d. $30,000 to $39,999 . . ☐
e. $40,000 to $49,999 . . ☐
f. $50,000 or more . . . ☐

Thank you very much for your time and cooperation in completing this questionnaire.

PLEASE RETURN THIS QUESTIONNAIRE IN THE ENCLOSED SELF-ADDRESSED ENVELOPE TO:

WASHINGTON ENERGY EXTENSION SERVICE
North 222 Havana
Spokane, Washington 99202

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